SAVANNA WOODLAND, FIRE, PROTEIN AND SILK IN HIGHLAND MADAGASCAR

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ABSTRACT.—Anthropogenic fire above 900 m elevation on Madagascar has created several discrete zones of savanna woodland dominated by tapia *(Uapaca bojeri)*. This tree, preadapted to surviving periodic burning, provides edible fruit, firewood and medicinal bark, but it is most important as a host plant to several useful lepidopteran insects. *Borocera madagascariensis* has been a source of silk made from its wild cocoons in tapia groves. Use of this fabric, still made on hand looms, is largely confined to shrouds for the elaborate reburial ceremony of the Merina and Betsileo ethnic groups. In addition, the pupae of *Borocera* and *Tagoropsis* are gathered and eaten by rural folk. Caterpillars that live on tapia leaves belonging to three different genera are also consumed, and the adult male of still another species is avidly sought for sale to butterfly collectors. A major shift in burning practice, fuelwood demand, mortuary ritual, or dietary custom could spell the end of this man/plant/animal symbiosis.

INTRODUCTION

On almost every continent and climatic zone, fires set by man have destroyed some plant communities while creating others. Periodic burning is now accepted as necessary to sustain certain ecosystems, and the only debate is how many of the fires were caused by lightning and how many by human agency. These "pyrophytic deformations" as Carl Sauer (1956:55) once called them, go far back enough in time to be viewed as part of the natural order. It is in the tropics that the cultural ecology of fire is the most pervasive and complex, but also the least understood and controlled (Bartlett, 1956:692-720). Anthropogenic burning of the various types of tropical forest has affected in both positive and negative ways the livelihoods of millions of traditional folk.

In few other places has fire disturbance had more far-reaching consequences than on the island of Madagascar in the Western Indian Ocean. Some 1,500 years of human settlement on this "isle of fire" have greatly modified its primeval vegetation. The early inhabitants, who came from Southeast Asia probably by way of the East African coast, were confronted with a Texas-sized territory whose original plant cover has usually been described as an evergreen forest of endemic species. Future research may modify this generalization, but what seems clear is that human modification has greatly changed the original vegetation. The highland interior, where half of the Malagasy population now lives, is the most transformed part of the island. Burning, and to a lesser degree cutting and overgrazing have removed all but tiny remnants of the native forest cover on the plateau. Slash and burn agriculture has long been superseded by paddy rice cultivation in the valley bottoms. It is the grass-covered hills that people still regularly burn to permit tender green shoots to replace the unpalatable withered culms in the dry season before onset of the rains. Land may also be torched at any time to eliminate grass and shrub species which are not palatable to cattle. In addition, incendiarism of the land rages over Madagascar as a way of expressing political or social discontent. For whatever cause, anthropogenic fire, favored by the ready combustibility of a long dry season, has created vast expanses of grass or tree savanna. The original highland forest of rich endemic diversity has not regenerated even in areas no longer burned. As on many other islands, evolution of the flora in isolation did not adapt native species to successfully cope with outside disturbances. The human ecology of Madagascar is attuned to the cultural inevitability of periodic fire, a process that highlights the futility of classifying phenomena attributable to culture from those considered to be "natural."

THE FIRE-DEPENDENT WOODLAND

In many places only one tree species, tapia *(Uapaca bojeri)* comprises this savanna woodland. Tapia is in the family Uapacaceae which includes only one genus, *Uapaca*, comprised of 62 species, 50 of them in Africa and 12 in Madagascar. Before human intervention, tapia was but one among many arborescent species that comprised the highland vegetation. Its heliophily suggests an ecological position in open habitats in the otherwise dense forest created by natural disturbances. Unlike most other forest components, tapia was able to survive burning and even thrive in the much reduced competition of its new habitat. Its thick, deeply fissured bark shields the cambium from fire, and a woody endocarp inside a fleshy drupe offers double protection to the seeds within. Vegetative reproduction is at least as important as seed germination. Suckers from underground meristems or stumps can develop into trees, an origin betrayed by multiple twisted trunks.

Low species diversity is another indication that savanna woodlands are an ecological response to periodic fire. Tapia is often the sole tree, although such stands are less homogeneous in areas with negligible human population (Fig. 1). Other tree species if present tend to mimic tapia in structural adaptation as a result of burning that has eliminated those that are fire-intolerant. These occasional cohorts include *Sarcolaena oblongifolia, Cussonia bojeri, Leptolaena bojeriana* and *Asteropeia densiflora* (Koechlin et al., 1974). Uniformity of size is also characteristic: the vast majority of tapia trees are from 8 to 10 m high with a diameter of 20-40 cm. Tapia cannot regenerate in its own dense shade, yet small saplings are rare even on the sunny margins where competition for light is less. Such an even-age pattern reflects burn periodicity. Ground fires systematically kill the tapia seedlings and sprouts, a suppression that results in the eventual eclipse of tapia groves as the old individuals die off. Bosks of full-sized tapia specimens reflect the absence of an intense fire for at least a decade. Many flourishing trees grow between rock outcrops where fire cannot easily spread. Fire also accounts for the lack of leaf litter. Instead grasses in the genera *Aristida, Loudetia, Trachypogon* and *Isalus* cover the ground under the trees. During fires, these herbs become the combustible material that spreads to and kills any tapia seedlings.

Tapia woodland covers about 130,000 ha in the two highland provinces of Antananarivo and Fianarantsoa. The former is the homeland of the Merina, the dominant Malagasy ethnic group; the latter is occupied primarily by the culturally similar Betsileo people. The Bara tribe, preeminently cattle herders, occupies southern Fianarantsoa province. A few small tapia groves also occur in the higher portions of Toliara (formerly Tuléar) Province. Distribution of tapia falls into three major and one minor zones within which individual groves, large and small, are surrounded by pure grassland (Fig. 2). Tapia copses range from 800 to 1,600 m above sea level and receive between 900 and 1,400 mm of yearly rainfall. Sclerophyllous leaves that reduce evapotranspiration and a spreading root system that garners soil moisture over a wide area help tapia to cope with the long dry season that extends from May to November.

In view of the rampant forest destruction on Madagascar, the sheer persistence of these woods is remarkable, especially given the status of the land and trees as commonheld property to which is attributed so much irresponsible land use. Both negative and

FIG. 1.—A pure grove of tapia trees *(Uapaca bojeri)* bordered by rice terraces in the Vakinankaratra region of Antananarivo Province. With very little competition from other plants, slow-growing tapia is able to spread its rounded crowns.

positive factors have spared tapia groves from total destruction. The slow growth of tapia wood and its low BTU yield have made this species unattractive as a source of charcoal. Elsewhere on Madagascar, charcoal makers and ironsmiths have illegally cut many tracts of remaining primary forest in response to the insatiable demand for domestic fuel and metal goods. Reinforcing the salvation of tapia groves on this otherwise denuded plateau is their affirmative value to man who has had an ethnobiological relationship with not just the plants, but also several resident invertebrate animals.

THE SILKWORM CONNECTION

Tapia is the host plant of a native silkworm *Borocera madagascariensis*, placed in the family Lasiocampidae (La Jonquière, 1972). It is thus not closely related to the domesticated Chinese silkworm *(Bombyx mori)* which belongs to the Bombycidea, lives on mulberry leaves, and forms the source of most of the world's silk. Collecting *Borocera* cocoons, processing them, unravelling the filaments to spin into thread, and weaving that into a silk called ***landibe*** have been part-time activities of highland rice-growing peasants for several hundred years.[1] Native silk is one of the more than a dozen fibers

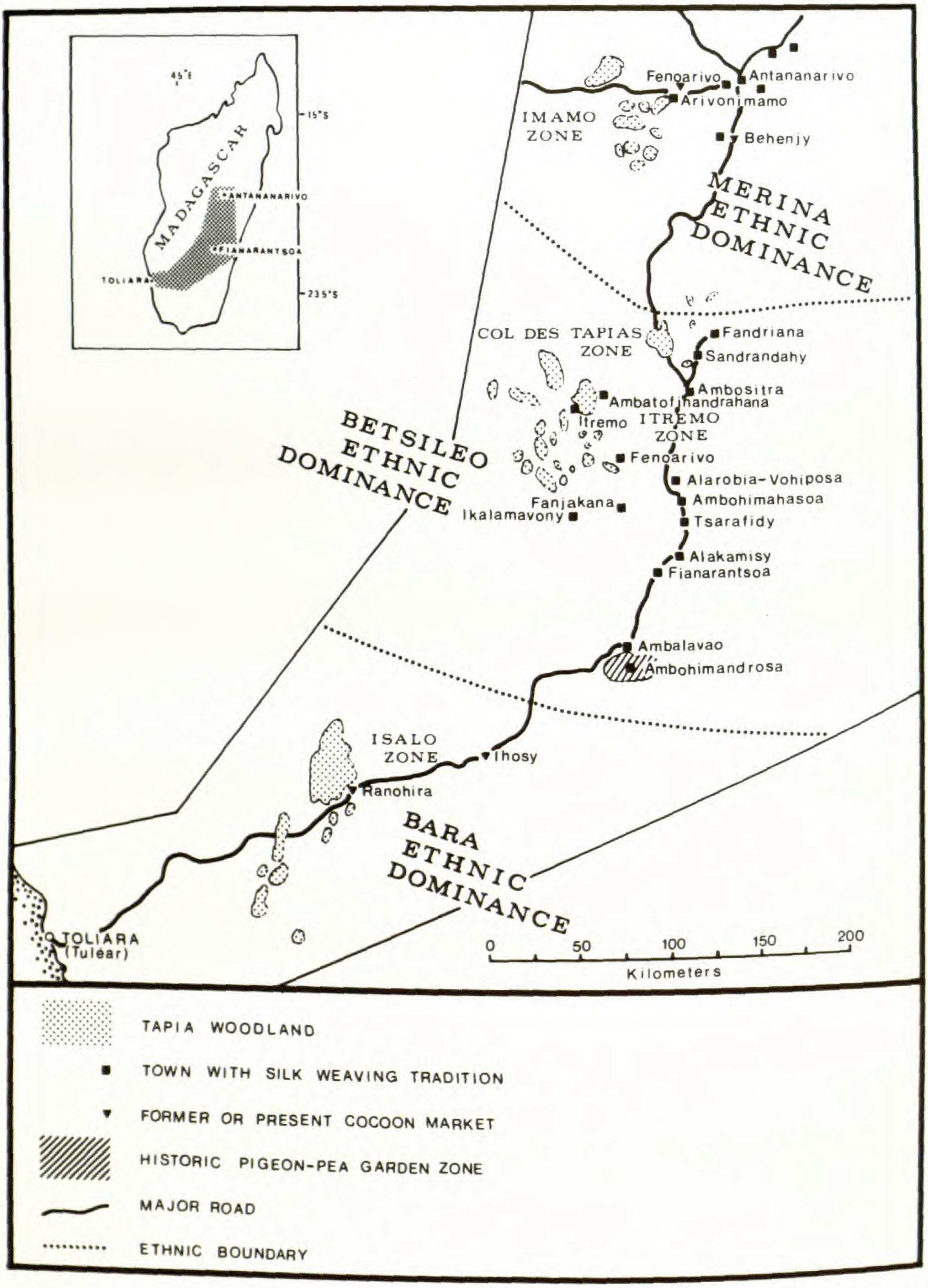

FIG. 2.—Location of tapia groves in Highland Madagascar and towns associated with ***landibe*** cocoon processing and native silk production.

used in the Malagasy weaving tradition which pre-dates European contact but which was later affected by Western influences.[2] ***Landibe*** owes nothing to the silk of China and Europe, called ***landikely*** in Madagascar. Under impetus of the French colonial administration, the domesticated Chinese silkworm was raised on the island, but *Bom-*

byx sericulture has now disappeared from most of its former sites except in several towns near Antananarivo.

Like all lepidopterans, *Borocera* goes through a multiphased metamorphosis from egg to larva (caterpillar) to pupa (chrysalid) and finally to the adult moth (imago). Unless fire intervenes, two generations ensue in a year, one that hatches in April-May, the other in November-December. Reproduction and growth are favored by periods of sunshine mixed with frequent rains. The female moth, three times larger than the male, lays 400-500 eggs which hatch after ten days and develop into hairy reddish-gray caterpillars with black and white spots. In their thirty-day feeding phase, they voraciously consume tapia leaves which are fleshy, high in water content, and slightly salty in taste. During this period, they undergo four molts after which they fashion cocoons either on a tapia branch or nearby tufts of grass. Before the pupa emerges to become a moth, large numbers of cocoons are collected as the raw material for native silk. Unlike the domesticated Chinese silkworm, the lifecycle of *Borocera* requires no human intervention, though informants indicate that the process has been facilitated in various ways. People have sprinkled tapia trees with water during dry spells; transplanted grass to certain locations near the trees on which larvae can spin their cocoons; and dug small trenches to form a barrier to caterpillar rambling. Emerging moths have been caught and tied to tiny sticks on which they deposit their eggs; the sticks are then hung from tapia trees. Tapia woods without the silkworms have been periodically restocked with eggs or cocoons brought from elsewhere. During the larval stage, children sometimes patrol the grove to scare away caterpillar-eating birds.

The native Malagasy silkworm is not exclusively dependent on tapia. Its caterpillars will feed on the leaves of other plants, among them *Dodonaea madagascariensis*, a native shrub which was occasionally cultivated in the past to serve as larval host, and three introduced crops: pigeon pea *(Cajanus Cajan)*, guava *(Psidium Guajava)* and loquat *(Eriobotrya japonica)*. Pigeon pea, called ***ambarivatry*** in Malagasy and gallicized to ***ambrevade***, was the most successful of these alternatives to tapia. Fields of this leguminous perennial, grown in other countries primarily for its edible seeds, were established for its leaves as caterpillar fodder. It was grown quite widely since at least the eighteenth century, but most intensively by Betsileo peasants in the Ambalavao region. Unlike other host species, pigeon pea grew fast enough to accept larvae only six months after planting. Cultivation of this crop allowed native silk production in populated zones in the Betsileo region where there was an abundant labor supply but no nearby tapia woods. As described by elderly informants who remember this activity from their youth, the female moth ***(samoina)*** was tied by her wings to a pigeon pea stalk until she laid her eggs on it. The eggs clusters were carried into their dwellings until they hatched, after which the young caterpillars—handled gingerly because of their urticant hairs—were returned to the fields to feed on their own. A ditch dug around the plantation obliged the roving caterpillars to spin their silky cases on ferns or grass planted in strategic places within the perimeter.

Three cocoon harvests a year, efficiently gathered from a narrowly confined area, characterized this indigenous silkworm raising. However, ***landibe*** cocoons from pigeon pea gardens were only half the size as those from tapia groves, yielded darker and somewhat coarser silk, and sold for substantially less. ***Landibe*** production reached its peak in the first decade of the twentieth century, facilitated by a commercial network, part of which is still in place. Some villages near the tapia groves grew into cocoon markets; others emerged as weaving centers. ***Landibe*** manufacture declined for a cascade of reasons. The domesticated Chinese silkworm produced with cheap island labor an aesthetically superior fabric for export, a market with which ***landibe*** producers could not compete. Then silkworm diseases brought from Europe were transmitted to ***landibe***, which reduced the manufacture of all kinds of silk. Concurrently, inexpensive factorymade cotton cloth, imported and then domestic, lowered demand for silk garments. This sharp drop in the use of native silk brought an end to the feeding of *Borocera* silkworms in the 1940s, and the remaning production fell back on the cocoons collected from tapia groves.

The long process of making ***landibe*** fabric begins with collection of the raw material in January-February and June-July. Cocoons from tapia groves that are remote from human settlement or frequently burned may be collected once a year or less. Size of the harvest varies greatly from one year to the next which, in the aggregate, amounts to between 10,000 and 30,000 kg for the whole island, Peasants whose main occupation is rice farming but who live near the woodland margins scour the groves armed with a long hooked pole or a forked stick to gather the oval gray cocoons which have projecting urticant hairs that can easily penetrate the skin and cause infection. In some tapia areas, cooperatives sanctioned by the state have exclusive rights to cocoon harvest, elsewhere families collect them from designated clumps of trees. Even in periods of relative abundance, the return for labor expended is low. Collectors wander over considerable distances to find the cocoons which are scattered on tapia branches and nearby herbs. Overlooked cocoons help to assure successive generations but a portion of the collected raw material is also set aside to supply imagos for the next reproductive cycle.

Depending on the area, the raw material is sold as collected or women prepare it for spinning (Fig. 3). At Ihosy, the largest cocoon market on the island, processed ***(masaka)*** cocoons sell for more than twice as much as unprocessed ***(akora)*** cocoons. Using a knife, the cocoon is cut lengthwise, turned inside out and the pupa is removed. The cocoons are then soaked in a boiling lye solution of water and tapia wood ashes to dissolve the gummy substance which bonds them into a tight case. Washed in clean water, dried in the sun, and rolled to loosen the filaments, the cocoons are then unraveled onto a stick. The spinner twists together several filaments, sometimes using a wooden spindle ***(ampela)***, to obtain a thread which becomes the raw silk, either dyed or kept in its natural color.

Weaving is still done on a simple horizontal loom ***(tenona*** or ***fanenomana)*** supported by four stakes placed in the ground (Fig. 4). The rather coarse fabric produced from ***landibe*** thread resembles tussah, a strong durable silk derived from different species of wild saturniid silkworms in Asia. Formerly some Malagasy clothing of the highland region

FIG. 3.—Washed ***landibe*** cocoons. Sandrandahy (Province of Fianarantsoa).

FIG. 4.—A Betsileo weaver in Sandrandahy moves the shuttle on her horizontal loom. These traditional Malagasy looms are believed to be patterned after those in Indonesia.

was made of native silk, including men's suits that reflected a European fashion. But the traditional use of silk fabric in Madagascar was for the ***lamba,*** a rectangular piece of cloth still used by rural men and women to carry a baby or other objects or to be worn simply as a mantle. Locally distinctive designs of lambas emerged, each with its own dye, pattern, weave or fringe, among them the ***lamba andrino*** which was given to elderly folk as a sign of respect (Domenichini and Radimilahy, 1979). It, as well as most lambas and other island-made clothing, are now usually made of cotton. The major exception is the ***lamba mena*** or shroud from wrapping the dead.

BURIAL SHROUDS AND THE MALAGASY DEATH RITUAL

The two main highland ethnic groups, the Merina and the Betsileo, are the participants in an ancestor cult that requires the use of winding sheets.[3] So central to highland Malagasy culture is this belief that it has been integrated into the Christianity introduced by Protestant or Catholic missionaries from Europe. Before burial in the family tomb or temporary grave, a dead person is wrapped in a ***lamba mena.*** Some years after that initial interment, the shriveled remains of the corpse are exhumed during a three-day event known as the ***famadihana.*** Its high point is the "turning of the dead" ceremony in which the body fragments are placed in one or more new shrouds over the tattered shreds of the previous one and reburied in the family crypt. While ostensibly a death ritual, the emphasis is on revelry not eschatology. Dancing, drinking, feasting, singing and speechmaking reinforce the solidarity of an extended family whose members have travelled there sometimes from long distances.

Ceremonial tradition strongly favors a ***lamba mena*** made from ***landibe.*** This totally indigenous fabric is valued for its durability and resistance to natural decay, not for its beauty. In recent decades ***landibe*** has taken on the aura of a material more appropriate for the dead than for the living, and most highlanders choose cerements of native silk as a way of demonstrating obedience to the wishes of their forebearers. This tradition of using ***landibe*** remains strongest among members of the old noble caste ***(andriana)*** who see shrouds as a mark of family honor and identity. On a symbolic level, a parallel is drawn between the cocoon that forms a protective cover for the immobile pupa and the ***lamba mena*** of home-woven silk that shields the revered ancestor from the elements.

In the late nineteenth century, Merina traders in the Betsileo country began to contract with local women to weave burial shrouds in large quantities which the merchants resold in Antananarivo and other Merina towns (Raherisoanjato, 1980:256). Before that commercialization, an individual commonly ordered one or more ***lamba mena*** from a weaver to be saved and used upon his or her death. This old practice subsists among noble Merina families, especially in cases where the couple is childless. If acquired before burial, the ***lamba mena*** becomes a floor covering in the honored northeast corner of the dwelling. Not until the early 1900s did the generalized use of the burial shroud spread from the Merina to the Betsileo and from the elite to all classes. This increased demand for ***landibe*** and commercialization of cocoons played some role in the protection of tapia groves.

To make a ***lamba mena*** for an adult corpse, one must sew together several fabric pieces, so limited is the size of the web which can be produced on the native looms. These composites range from four to eight pieces, each 2.50 m wide and 50 cm long and called a ***vitrana.*** Close to 3.5 kg of raw material (about 5,000 cocoons) are needed to make one large shroud which takes months of part-time weaving. ***Lamba mena*** (literally "red mantle") were originally dyed a russet color which explains its conventionalized name, but today most are left their natural beige or tan (Fig. 5). Rarer shades, reflecting a localized cocoon source, range from silvery gray to blackish-brown.

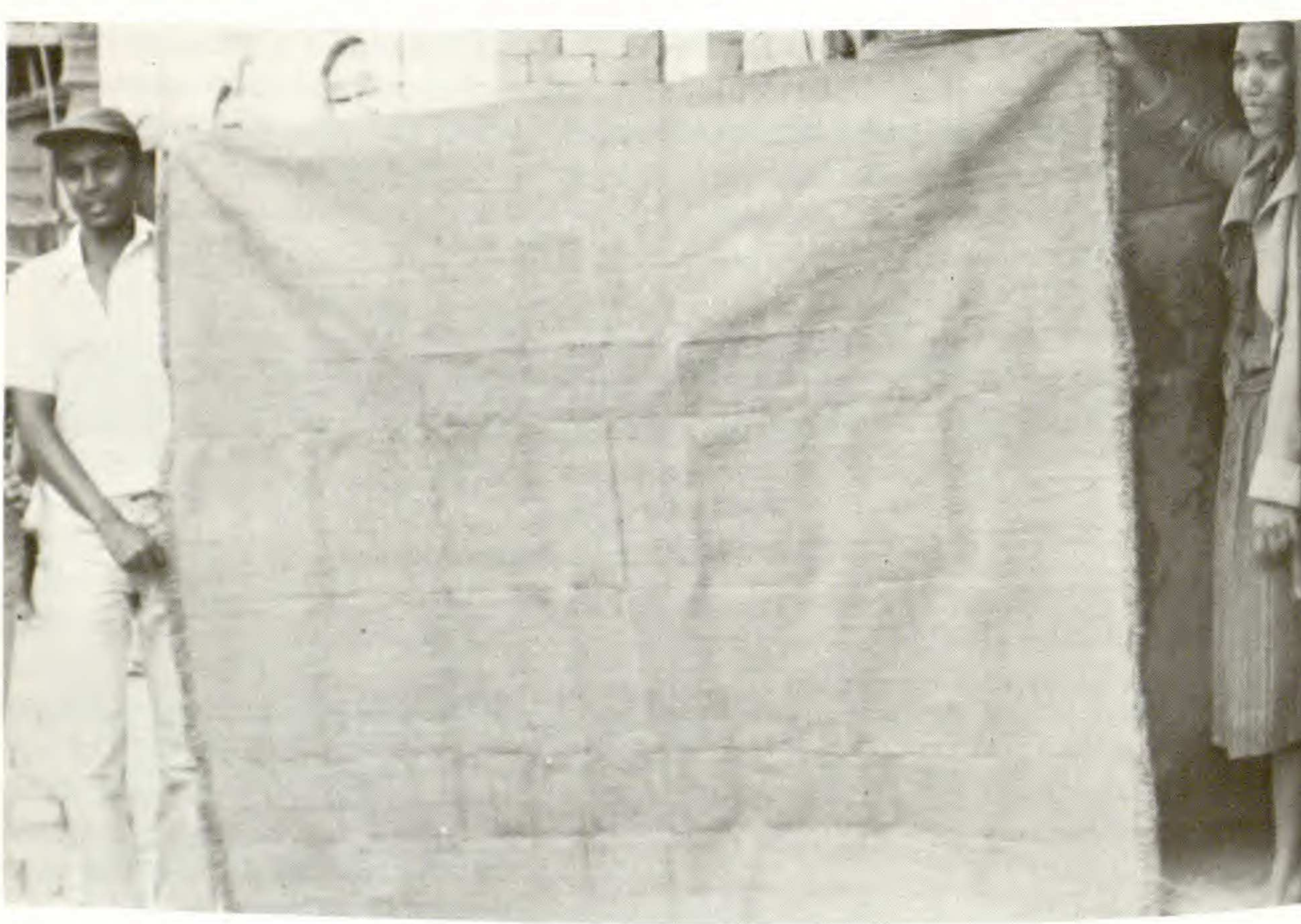

FIG. 5.—A large unfurled ***landibe*** to be used in rewrapping an adult corpse, one way in which the living keep their ancestors happy. Neither the texture nor the color fits the American image of silk.

Manufacture focuses today on Sandrandahy, a Betsileo town of ca 3,500 people where 80% of the women and girls are weavers. In an earlier time, Sandrandahy got its raw material from the tapia groves within walking distance to the north. Now about four metric tons of cocoons, unprocessed and processed, are brought in annually from as far away as Toliara.

The custom is a costly one: the retail price of just one ***lamba mena*** in 1985 ranged from 50,000 to 100,000 FMG (about $US100-200), depending on its size and quality. For a funeral, neighbors who are also kin contribute to the purchase of the shroud if the immediate family is unable to afford one. For the ***famadihana***, each close relative typically brings a new ***lamba mena*** to the event and other kinfolk are expected to offer money to help buy several more. The honored deceased may be bundled in as many as ten new shrouds, and any extra ones will be used to rewrap other bodies in the family tomb. The financial burden of providing numerous ***lamba mena*** as well as the other expenses explains why exhumation from a family crypt occurs only once or twice a decade. In a town of 4,000 people, about 100 ***famadihana*** can be expected in any one year. These extravaganzas are all concentrated between June and October, the post-harvest period when people have some cash, more free time, and travel is less impeded by mud.

TAPIA INSECTS AS HUMAN FOOD

The tapia tree is also the host of certain insects which people eat, a practice that has a strong tradition on the island.[4] Besides animal protein, insects provide occasional variation of texture and taste to the daily regime which is heavy in carbohydrates, primarily rice and manioc. Meat is not an everyday part of the diet; the dominant livestock, cattle, are prestige animals and are slaughtered only for special occasions. Entomophagy may have been especially encouraged in areas such as the Isandra valley where the Betsileo there followed a taboo against eating beef and rice at the same meal (Dubois, 1938:126).

Lepidopteran insects in two phases of metamorphosis—the caterpillar ***(fanday)*** and the chrysalid ***(soherina)***—are collected in the tapia groves. Of the two, chrysalids, especially of the *Borocera* silk moth, are the preferred delicacy and have long been sold in peasant markets (Ellis, 1859:367; Osborn, 1924:324). They are also available in markets in the capital city of Antananarivo from October to April, brought there from a 50 km radius. *Borocera* pupae are byproducts of the silk processing described. An incision is made in the cocoon to remove the chrysalid; if allowed to mature and emerge as a moth, the filaments would be useless for spinning. Chrysalids are often returned to cocoon harvesters in partial payment for their work. The pupae of *Tagoropsis* are gathered by scratching the ground to uncover them. The caterpillar in this cocoonless genus descends the tapia tree to undergo metamorphosis in the loose soil or under dead leaves. In two or three hours, collectors can fill a 40 kg sack of the pupae. they are killed in boiling water and eaten that way, or they are fried in oil; some people also cook them in the hot ashes of the hearth fire. Their flavor resembles that of fish.

Tapia is host to three species of edible caterpillars, the most important of which is ***bokana*** whose imago is a large saturniid moth. The insect under this name may actually fall into half a dozen different closely-related species of *Tagoropsis*. Beginning in February, ***bokana*** larvae develop from the eggs laid by the female moth. For six to eight weeks, the blackish caterpillars consume the tapia leaves, but only at night. During the day they hide from predators in the sinuous recesses of the bark or at the base of the trunk (Fig. 6). Some peasants assert that large populations of ***bokana*** in a grove coincide with a relative absence of ***landibe*** and that the reverse is also true. This apparent intergeneric competition is particularly noticeable west of Antananarivo where ***bokana*** is abundant and *Borocera* rare since the 1950s. For about half the year, cater-

FIG. 6.—An edible **bokana** caterpillar *(Tagoropsis* sp.), 3 cm long, crawls over the thick sinuous bark of a tapia tree in a grove near Masinatsimandrano, west of Arivonimamo.

pillar collectors, often children, enter the tapia groves with pails and sticks. The creepy-crawlies are brought back to the village where they are decapitated, soaked in salt water, and fried in oil. During its period of abundance, **bokana** supplements the mid-day meal of rice and/or manioc of many peasants in the tapia zones. One family consumes about two kg per week, an amount which increases in September when the household rice supply nears depletion. Caterpillars are also sold in markets to those townspeople who also eat them. Local informants assert that **bokana** consumption was formerly more common than it is at present. European missionaries and administrators on Madagascar undoubtedly prejudiced some people against eating caterpillars. High-caste individuals **(andriana)** refuse them, a possible reflection of their acculturation to Western values and food alternatives rather than a class-dictated taboo. Descendants of the former slave caste **(mainty),** which includes many impoverished people less touched by foreign ideas, appear to be the most avid caterpillar consumers.

Two other larvae are eaten much less. **Saroy** *(Antherina suraka)*, a black caterpillar with spots of green, yellow and turquoise, has been at times so abundant that it partially defoliates the tapia trees. **Saroy** is especially collected in July-August. Fried in oil, its taste is much less appreciated than **bokana.** A third edible kind is *fangotsoana* or *fangatsika*, which apparently includes several species of *Borocera* related to **landibe** but not useful as silk (La Jonquière, 1972). They are reportedly a human food source primarily during famines.

OTHER TAPIA RESOURCES

Tapia supplies additional products, not the least of which are the edible fruits, about the size of a cherry and containing vitamin C, that ripen in October and November (Fig. 7). The fruit is always gathered from the ground to circumvent a Madagascan taboo that prohibits picking those still attached to the tree; if violated the rice crop will be ravaged by hail. Sale of tapia fruit in highland markets late in the year supplements family

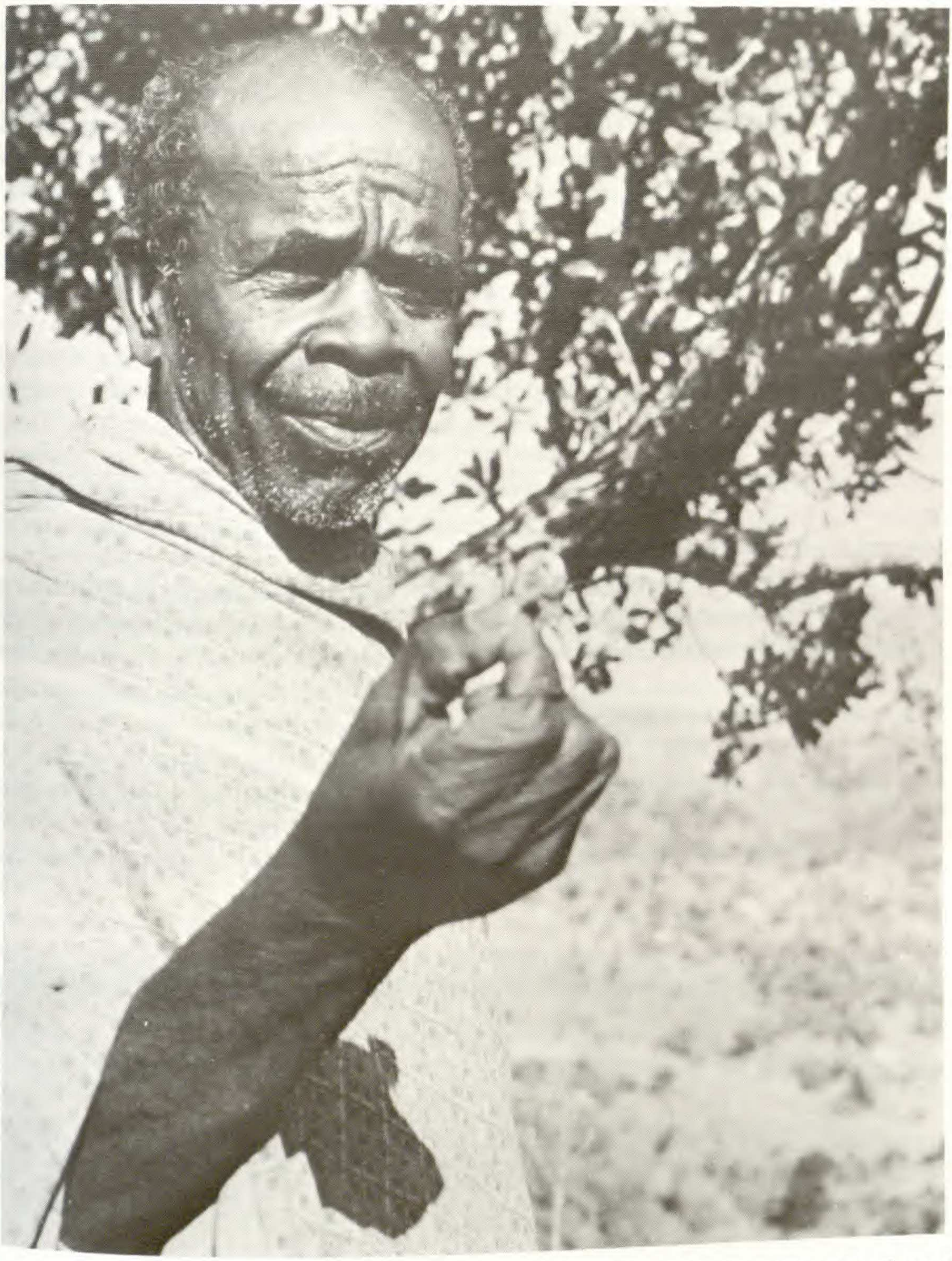

FIG. 7.—Betsileo peasant near the Col des Tapias holds a dried tapia fruit in his fingers.

incomes. A less seasonal though minor product is tapia bark, stripped from the trees and used in Malagasy folk medicine to relieve diarrhea.

Dead tapia trunks and fallen or broken boughs are gathered as combustible. Although light in density and quick-burning which make it less than the ideal firewood, its availability is a major advantage in the fuel-starved highlands. Residents near tapia groves have traditional rights to gathering (but not cutting) the wood, a year-round activity most assiduously done in November before the onset of the rainy season. Neighboring hamlets get their fuel supply from this source, and may also sell some of it elsewhere. Collection of tapia deadwood has a further value of cleaning the groves of accumulated trash which, if allowed to build up and burn, results in a firestorm that destroys the whole grove.

A nocturnal yellow moth, *Argema mittrei*, forms still another item of economic interest in the tapia woods. The adult male is one of the world's largst lepidopterans, having a wingspan of 18 cm and a length of 21 cm, part of which is a ribbon-like appendage (Griveaud, 1961:54-59). People supplement their incomes by capturing the male to mount and sell to butterfly fanciers and tourists. Netting often damages the specimen, so the preferred method is to raise them in captivity. Tapia trees and other plants are scrutinized for *Argema* egg cases and the unmistakable silver-colored perforated cocoons which are collected for their eventual metamorphosis into an imago ***(lolo*** in Malagasy).

TENUOUSNESS OF THE ETHNOBIOLOGICAL SYSTEM

The tapia-protein-silk association in Highland Madagascar is vulnerable on three fronts. Although it is clearly a "fire-type community," tapia groves can be nevertheless eliminated by an intense burn and replaced by pure grass such as now covers most of the region. Deliberately set blazes have victimized all wooded areas on Madagascar, whether they be vestigial patches of the climax forest, tapia bosks, or eucalyptus and pine plantations (Fig. 8). If mature tapia trees manage to survive fire, their fruit and useful insect populations do not. In the Itremo zone west of Ambatofinandrahana, cocoons are abundant in cycles of one year out of five, and in some places in the Imamo zone west of Arivonimamo, the sparse cocoon populations are not worth the harvest effort.

Wholesale felling of tapia trees for fuelwood is a second threat. Since the mid-1970s, oil and butane gas, all which must be imported, cost more than twice as much as wood or charcoal per kilocalorie generated. That sharp price difference has intensified the pressure on remaining island forests and woodlots. As the gap widens between the rate of tree cutting and replanting, the demand for cheap cooking fuel could soon sacrifice the more accessible tapia groves. The probable demise of native silk manufacture is a third factor working against the system. No modernization of the manual process has

FIG. 8.—Aftermath of a *feu de brousse* that swept through a tapia grove north of Ilaka (Province of Fianarantsoa) weeks before this photo was taken in September 1983.

occurred; a French attempt earlier in this century to reorganize and integrate this indigenous activity failed. Meanwhile, the number of weavers has greatly declined from that of several decades ago and many rural communities have totally abandoned this work. These changes have forced up labor costs which, when combined with high middleman profits, place the ***landibe*** burial shroud as a major expenditure. One ***lamba mena*** fetches a price that exceeds a third to a half of the annual cash revenues of most people. High cost of the shroud, especially in the face of deteriorating family incomes everywhere on the island, makes it difficult to meet one's kindred obligations. A practice whose function is primarily social is more likely to be modified than one directly related to subsistence security. Given its role in Malagasy culture, the shroud concept is outlasting the native silk association. Indeed, a cotton ***lamba mena*** costs one fifth, and those of Chinese silk ***(landikely)*** one third as much as ***landibe.*** If ***landibe*** is totally replaced in mortuary ritual, the main rationale for maintaining the tapia groves will disappear.

Whatever the fate of Madagascan folk ecology in coming years, this specific relationship exemplifies an important concept too often overlooked. "Culture" and "nature" are not the independent categories that we often like to ascribe to them. In some places, plant and animal populations that we normally classify as "wild" and thus part of the biophysical environment owe their presence to human intervention. This realization by itself refutes the dubious notion that technologically simple societies have their subsistence patterns dictated by an immutable Nature.

NOTES

[1]Silk is mentioned in the journals of most early European visitors. The best published descriptions of native silk production date from the French colonial period: Gouvernement (1899:II); Cordemoy (1901); Grangeon (1906); Martonne (1906); Anonymous (1915); and Dubois (1938:282-294).

[2]Raw materials formerly woven by the Malagasy included several species of native wild plants, three introduced fiber-bearing species (agave, hemp and banana) and even the flossy dragline of a spider called ***halabe*** *(Nephela madagascariensis)*. Now only cotton, rafia, and silk survive as materials still woven.

[3]Bloch (1971) provides the most trenchant analysis of the death cult among the Merina; Kottak (1980:211-259) describes it among the Betsileo.

[4]The Malagasy inventory of edible insects is large and includes species in at least seven orders: Lepidoptera, Orthoptera, Hemiptera, Homoptera, Neuroptera, Hymenoptera and Coleoptera. Widespread over the island as sources of food are migratory locusts *(Locusta* sp and *Nomadacris* sp), easily captured as they swarm at certain times of the year. Crickets especially the ***sahobaka*** *(Brachytrypes membranaceus)* are trapped as they emerge from their nests made in alluvial soil. A third preferred comestible is the ***sakandry*** *(Pyrops madagascariensis)* a fulgorid planthopper that parasitizes Lima bean and related plants. Dried, this insect is much appreciated, especially in the Majunga region.

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